A SCENT-STATION SURVEY OF MEDIUM-SIZE MAMMALS ON THE CALLAWAY PRESERVE, HARRIS COUNTY, GEORGIA

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A Scent-Station Survey of Medium-Size Mammals on the Callaway Preserve,
Harris County, Georgia
by
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A Thesis Submitted in Partial Fulfillment of
Requirements of the CSU Honors Program

for Honors in the degree of
Bachelor
in
Biology,
College of Science,
Columbus State University

Thesis Advisor _____ Date 7 May '08

Second Reader _____ Date 9 May 2008

CSU Honors Program Director _____ Date 12 May 2008

CAT 7.10.08

Abstract

The objective of this project was to determine the relative abundance of medium-sized mammals on the Callaway Preserve in Harris County, Georgia, using the scent-station technique, to determine species preference in regard to habitat, to compare relative abundance of species in regard to habitat, and to compare habitats in terms of the species present. Thirty-six scent-stations were established on the property and monitored to observe the presence of coyotes, raccoons, armadillos, foxes, opossums, and skunks. Of the total number of visits to the scent-stations, 36.36 % were coyotes, 18.18% were foxes 22.73% were armadillos, and 22.73% were raccoons. Only one opossum and no skunks visited the stations, thus the data was not included. The visitations of four species, coyotes, foxes, armadillos, and raccoons, were compared with respect to three types of habitat: Upland Hardwoods / Ridge, Upland Pines, and Mixed Hardwoods / Pines. The statistical significant difference in coyote observations suggested that they prefer the Upland Hardwoods / Ridge habitat. The lack of statistical, significant difference in other species observations suggested that these species have no habitat preference. The results indicated there was no significant difference in relative abundance of these species among these habitats. Also, the results indicated there was no significant difference in species richness among these habitats.

Introduction

Determining the abundance of certain species of animals is one of the major objectives of managers and researchers in the field of wildlife biology (Sargeant et al. 1998). Observing changes in animal abundances can be extremely important assessing changes of habitat, certain harvests of land, and population variability (http://files.dnr.state.mn.us 2006). However, finding medium-sized mammals can be a problem as they are often in low population densities and inhabit secluded areas and techniques used to determine abundance can be costly and inaccurate (Sargeant et al. 1997, Sargeant et al. 1998, http://files.dnr.state.mn.us 2006). To save money and possibly provide more accurate results, surveys to determine the relative abundance of a population are often employed.

Usually indicated as an index, relative abundance is an estimate of the actual abundance of a species in an area. A few techniques that have been used in numerous surveys to determine relative abundance include species identification through scat, hair snares, cameras, and scent-stations using sand or soot (http://files.dnr.state.mn.us 1999).

In 1994, researchers used previous scent-station surveys to analyze data on the relative abundance of raccoons over the period of a year and a half (Smith et al. 1994). In 2001, researchers in Nebraska used the technique to observe the relative abundance of the endangered Swift Fox (www.ngpc.state.ne.us 2001). Unexpectedly, there was a high number of visitations to their scent-stations. In 2005, scent-station surveys were conducted to determine if a thick shrub layer would affect the abundance of coyotes in certain habitats (Guevara et al. 2005).

The main goal of the scent-station technique was to establish if an animal visited the location. The premise behind the technique is to place an attractant in the middle of a pile of sand or an aluminum plate filled with soot (http://files.dnr.state.mn.us 1999). Once the animal has visited the scent-station, it leaves its tracks either in the depressed sand, or on the plate as a result of picking up the soot with its paws.

Often, the attractant used in the scent-station technique are fatty acid predator survey disks (Sargeant et al. 1996). These survey disks give off an unpleasant odor that is attractive to some animals. These discs consist of plaster saturated with fatty acids. As the fatty acids in the discs decompose through a process called rancidification when left out of a closed container, the discs produce noxious and unpleasant odors that draw the animal towards the disc.

The animals of interest to this particular survey include the coyote *(Canis latrans)* (**Figure 1**), raccoon *(Procyon lotor)* (**Figure 2**), armadillo *(Dasypus novemcincuts)* (**Figure 3**), fox *(Urocyon cinereoargenteus)* (**Figure 4**), skunk *(Mephitis mephitis)* (**Figure 5**), and opossum *(Didelphis virginiana)* (**Figure 6**).

The tracks of these species are very different from each other, but require some practice to identify. Coyote tracks (**Figure 7**) are very similar to those of dog tracks, however they are more elongated and narrow (Croft pers. comm.). Fox tracks (**Figure 8**) are also quite similar to those of coyotes, but they are about half the size. Raccoons (**Figure 9**) have opposable thumbs present in their tracks, as well as a pointed heel on the hind foot. Skunk tracks (**Figure 10**) look like tiny bear tracks. What makes opossum tracks (**Figure 11**) distinct from the similar raccoon tracks is the elongated toe which is rotated nearly 180° from the four anterior facing toes on the hind feet. Lastly, the tracks

of armadillos (**Figure 12**) are very distinct in that they have triangular shaped toes, much like a maple leaf.

Methods

This survey was conducted on the Callaway Preserve in Harris County, Georgia, during the second week of each month of June and July. The fatty acid predator survey disks were purchased from the Pocatello Supply Depot in Pocatello, Idaho. The sand was purchased from a local landscaping shop in Pine Mountain, Georgia, while all other supplies were purchased from a local supermarket.

A 5-gallon bucket was filled completely with fine playground sand and approximately 2 ½ cups of mineral oil was added. The components were mixed using a stirring motion with a garden shovel. The mixture was agitated until the mineral oil was completely absorbed and evenly distributed throughout the bucket of sand.

The sand mixing technique was repeated with ten more buckets of sand and mineral oil. The buckets, as well as the garden shovel and a heavy-duty garden rake, were securely fastened to a trailer hooked to the back of an All-Terrain Vehicle that was used as the primary mode of transportation for this experiment (**Figure 13**). The sand was transported to each of thirty-six locations to set the scent-stations. Each scent-station was placed in various locations alongside the unimproved forest roads that traveled through the property. The scent-stations were placed 0.5-4 meters from the edge of the roads. The scent-stations were placed at intervals ranging between 300 and 450 meters on alternating sides of the road.

The area surveyed in the present study is known as the Callaway Preserve which is located in Harris County, Georgia. For the purposes of this survey, selected scent-stations in the Callaway Preserve were grouped into primary habitat types (**Table 1**), due to dominant tree species present, and included Upland Hardwoods / Ridge, Upland Pines,

and Mixed Hardwoods / Pines (Croft pers. comm.) The Upland Hardwoods / Ridge habitat contained dominant trees including Northern Red Oaks, White Oaks, Scarlet Oaks, Southern Red Oaks, Post Oaks, and Hickory Trees (Croft pers. comm.). The Upland Pines habitat contained dominant trees including planted Loblolly and Longleaf Pines (Croft pers.comm.). The Mixed Hardwoods / Pines habitat contained dominant trees including planted Loblolly Pines, Sweetgum Trees, Water Oaks, White Oaks, Northern Red Oaks, and Poplar Trees. These three habitats were chosen as they contained similar numbers of scent-stations in each habitat. The Upland Hardwoods / Ridge habitat had eight scent-stations, the Upland Pines habitat had eight scent-stations, and the Mixed Hardwoods / Pines habitat had six scent-stations. The remaining scent-stations were not included in these habitats and thus any data recorded from these sites were not used in the statistical analysis.

At each location, the establishment of the scent-station began with first clearing the area of all debris. The sand was poured onto the cleared area (**Figure 14**) and formed into a circle with a diameter of 1 meter. Sand was poured to a depth of at least 0.025 meters. The sand was manually leveled to create a flattened plain for track detection (**Figure 15**), and then swept using a feather duster, or pine tree branch containing many pine needles, to remove any remaining clumps or debris (**Figure 16**). One fatty acid predator scent tablet was placed in the middle of the circle of sand.

Any remaining debris surrounding the scents-station, such as leaves, sticks, and vines, were placed near their original locations to allow for a more natural, undisturbed look. This technique was used on all thirty-six scent-station locations.

The establishment of each of the scent-stations occurred one day before the beginning day of data collection. Data were collected in the mornings, starting at 8:00 am, over the period of five consecutive days. Additional fatty acid predator scent tablets, latex gloves, and the feather duster were carried during all observations. Any unusual or unidentifiable tracks were photographed for later identification.

During each day, all thirty-six locations, were observed in the order as shown in **Figure 17**. Each scent-station was examined and the animal tracks of those species present were recorded. The animal tracks of interest included those of coyote *(Canis latrans)*, raccoon *(Procyon lotor)*, armadillo *(Dasypus novemcincuts)*, fox *(Urocyon cinereoargenteus)*, skunk *(Mephitis mephitis)*, and opossum *(Didelphis virginiana)*.

After each observation, each scent-station was manually leveled and feather dusted to remove any debris and prepare for observations the next morning. If the fatty acid tablet was eaten or moved, it was replaced.

When rain occurred the previous night, observations and data collection were still attempted. Scent-stations whose presence of tracks was unidentifiable were noted as being "rained-out" and not included in the data. As with the other scent-stations, those that were "rained-out" were again manually leveled and feather dusted to prepare for the next mornings observations. Before the second surveying in July, the scent-stations were reestablished, as the mineral oil evaporated and sand had washed away during the intervening month.

Analysis of the data included counting the number of visits by each species over the total period of data collection at each station. The number of visits by each species was analyzed as a percent occurrence according to the habitat type in which the stations

were located. Only data obtained from scent-stations located in the desired habitats were used in analysis. Furthermore, the data obtained from the scent-stations located in three of the primary habitat types were analyzed using a Chi-square analysis to determine habitat preference, relative abundance of species among the three habitat types, and species richness among the three habitat types.

The null hypothesis used in comparing the species with habitat type was that the observed frequency of visits was equal to the expected frequency of visits, and thus there was no preference in habitat. When comparing the relative abundance of the species in regards to habitat, the null hypothesis used was that the relative abundance of all of these species was equal among the three habitats. When comparing species richness among the three habitat types, the null hypothesis used was that the species richness of the three habitats was equal.

Results

During the course of the survey, thirty-six scent-stations were examined. During the five days in June and five days in July when data were collected, the presence of five species of medium-sized mammals was determined. The tracks of coyote, raccoon, armadillo, fox, and opossum were recorded as displayed in **Appendix 1**. No skunk tracks were evident. A few scent-stations, stations 3, 6, 28, 31, 32, and 36, were visited by more than one species on a particular morning. Collectively, there were 99 total visits to the scent-stations, however only 66 visits were located in the selected scent-stations located in the three habitats.

Of the 66 total visits that were significant to the data, the total number of visits by each species, and their comparative percentages, are indicated in **Figure 18** and **Figure 19**. Coyotes visited scent-stations 24 times, which was 36.36% of the total visits; foxes visited scent-station 12 times, which was 18.18 % of the total visits; armadillos visited scent-stations 15 times, which was 22.73% of the total visits; and raccoons visited scent-stations 15 times, which was 22.73% of the total visits. Visits by opossums and skunks were not included in this data.

The number of visits of each species was compared with the three types of habitat in the area. The percentages of visitations to these locations by coyotes is represented in **Figure 20**. Coyotes primarily visited scent-stations in the Upland Hardwoods / Ridge habitat, indicated by 66.67% of the total visits. The percentages of visitations to these locations by foxes is represented in **Figure 21.** The foxes primarily visited scent-stations located in the Upland Pines habitat, indicated by 50.00% of the total visits. The percentages of visitations to these locations by armadillos is represented in **Figure 22.**

Armadillos primarily visited scent-stations located in the Upland Pines habitat, indicated by 46.67% of the total visits. The percentages of visitations to these locations by raccoons is represented in **Figure 23**. Raccoons primarily visited scent-stations located in the Upland Hardwoods / Ridge habitat, indicated by 40.00% of the total visits.

Additionally, the visits of all species, excluding opossum and skunk, were analyzed to determine habitat preference, relative abundance, and species richness in regards to the three primary habitats: Upland Hardwoods / Ridge, Upland Pines, and Mixed Hardwoods / Pines. There was significant ($\chi^2 = 12.26$; d.f. = 2; P = 0.05) difference in visitation by coyotes to the above three habitats. There was no significant difference in visitation to the three habitats by foxes ($\chi^2 = 3.50$; d.f. = 2; P = 0.05), armadillos ($\chi^2 = 2.80$; d.f. = 2; P = 0.05), or raccoons ($\chi^2 = 0.40$; d.f. = 2; P = 0.05). The data indicate that there was not a significant difference ($\chi^2 = 10.53$; d.f. = 6; P = 0.05) in the relative abundance of coyotes, foxes, armadillos, and raccoons among all three habitats. Also, all species were present in each habitat, so the data indicate that there was not a significant difference ($\chi^2 = 0$; d.f. = 2; P = 0.5) in the species richness among the three habitat types.

Discussion

As noted in the results, there were 66 visitations of significance to the scent-stations. The majority of the visitations were those of coyotes, with an overall 36.36% of the total visits. The visitation percentages of raccoons (22.73%) and armadillos (22.73%) were very similar, while the percentages of the foxes (18.18%) were much lower than that of the coyote.

Because these results indicate a relative abundance of species at the present time, one can only speculate that there is a higher relative abundance of coyotes than other species on this property. Previous research of scent-station data show that there is no statistical model that will fit appropriately to give accurate results of actual abundance (Sargeant at al. 1997). However, we can use statistical analysis to determine habitat preferences for each species and an overall relative abundance of species.

The number of visits of each species over the course of data collection was compared to the three primary habitats: Upland Hardwoods / Ridge, Upland Pines, and Mixed Hardwoods / Pines. The preference of coyotes for the Upland Hardwoods / Ridge habitat in comparison to the Upland Pines or Mixed Hardwoods / Pines habitats was significant. These data do not indicate why coyotes prefer the Upland Hardwoods / Ridge habitat, nor do they indicate the factors that influence the coyotes to visit other habitats less often. These factors can be tested further in future research of this area. The Chi-square analysis of the fox, armadillo, and raccoon data indicate that these species had no habitat preference. As noted previously, these data do not indicate why the species had no habitat preference.

When comparing the relative abundance of coyotes, foxes, armadillos, and raccoons in regards to the three habitats, there was not a significant difference. This indicates that there is equal relative abundance among the Upland Hardwoods / Ridge, the Upland Pines, and the Mixed Hardwoods / Pines habitats and that these habitats were equally active sites, as indicated by the equal number of visits of these species to each of these habitats. These data do not indicate the influence these species have on each other and can be researched in the future.

When comparing the species richness of species in regards to the three habitats, there was not a significant difference. This indicates that there is equal species richness among the Upland Hardwoods / Ridge, the Upland Pines, and the Mixed Hardwoods / Pines habitats.

These data can also be used in a long-term study of the same area. If results show, for example, there is a high relative abundance of a particular species this year, and there is a dramatic drop over the next few years, one can infer that there is a drop in abundance of that particular species in the area. If this survey is continued annually, the data obtained could provide information regarding the relative abundance of medium-sized mammals on the preserve over a period of time.

More accurate results might have been obtained by reducing sources of error in this survey. At a few stations, the animals had shifted the sand so much that some tracks were difficult to identify. The rain also made reading tracks quite difficult on occasion. Human error by misidentifying tracks could have been a factor. The tracks of coyotes are very similar to those of dogs and have easily been misidentified.

If different techniques had been employed to collect data, different or more accurate results might have been obtained. The use of motion-sensor cameras would be beneficial as the photographs could be compared with the data obtained from the tracks. This technique would have eliminated misidentifications as well as recorded the presence of animals whose tracks had been disrupted. Performing this survey at different times of the year or more often during the year could have provided more data. Collecting data at a different time of day might have provided different results as human disturbances could be an influential factor in visitation rates. The use of different attractants, or the quantity that was used, could have different results. Also, placing the scent-stations closer or farther apart might result in a change in visitation by these species. All of these factors are possibilities that should be considered when conducting this survey again.

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Figure 2:

< http://www.nps.gov/archive/cuva/kidstuff/alphabet/r.htm>.

Figure 3: < http://student.britannica.com/comptons/art-52802/Nine-banded-armadillo?&articleTypeId=31>.

Figure 4: < http://www.dnr.state.md.us/wildlife/habichat16.asp>.

Figure 5:

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Figure 6:

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Figures 7-11:

<http://www.mass.gov/dfwele/dfw/dfwpdf/dfwtrax.pdf>.

Figure 12:

< http://www.backyardnature.net/101/mamkey04.htm>.

Table 1. The scent-stations established in each primary habitat type on the Callaway Preserve, Harris County, Georgia.

Upland Hardwoods / Ridge	18-20, 27-31
Upland Pines	2, 4-5, 13-15, 32-33
Mixed Hardwoods / Pines	7, 21, 22, 24, 25, 35

Figure 1. The coyote (*Canis latrans)*, one of the mammals surveyed on the Callaway Preserve, Harris County, Georgia.

Figure 2. The raccoon (*Procyon lotor)*, one of the mammals surveyed on the Callaway Preserve, Harris County, Georgia.

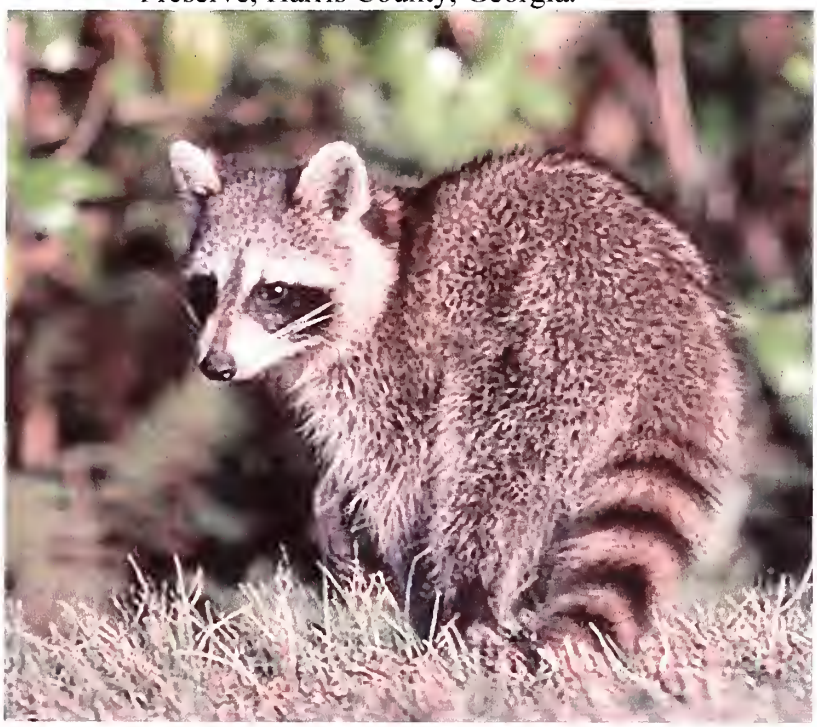


Figure 3. The nine-banded armadillo (*Dasypus novemcincuts)*, one of the mammals surveyed on the Callaway Preserve, Harris County, Georgia.

Figure 4. The grey fox (*Urocyon cinereoargentetu)*, one of the mammals surveyed on the Callaway Preserve, Harris County, Georgia.

Figure 5. The striped skunk (*Mephitis mephitis)*, one of the mammals surveyed on the Callaway Preserve, Harris County, Georgia.

Figure 6. The opossum (*Didelphis virginiana)*, one of the mammals surveyed on the Callaway Preserve, Harris County, Georgia.

Figure 7. Tracks of coyotes surveyed on the Callaway Preserve, Harris County, Georgia.

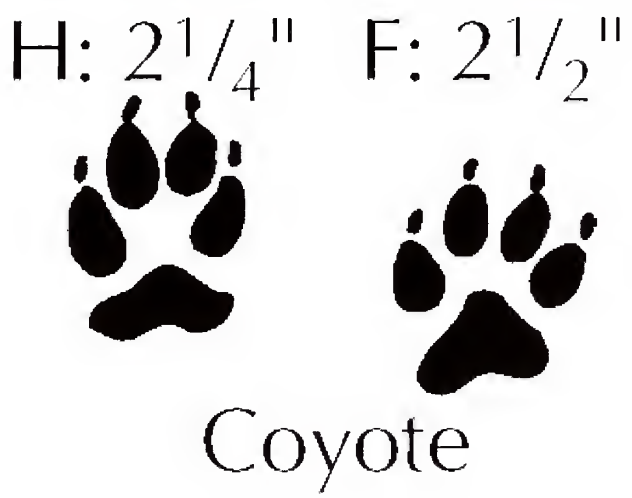


Figure 8. Tracks of gray foxes surveyed on the Callaway Preserve, Harris County, Georgia.

Figure 9. Tracks of raccoons surveyed on the Callaway Preserve, Harris County, Georgia.

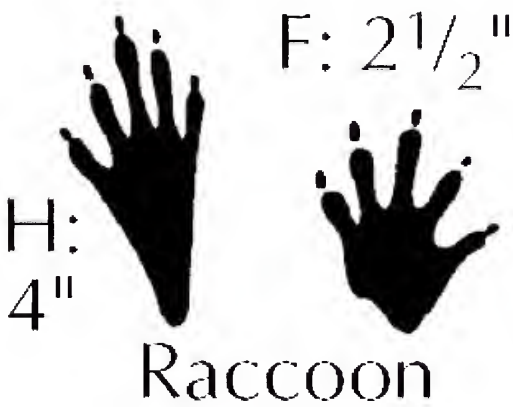


Figure 10. Tracks of striped skunks surveyed on the Callaway Preserve, Harris County, Georgia.

Figure 11. Tracks of opossums surveyed on the Callaway Preserve, Harris County, Georgia.

Figure 12. Tracks of armadillos surveyed on the Callaway Preserve, Harris County, Georgia.

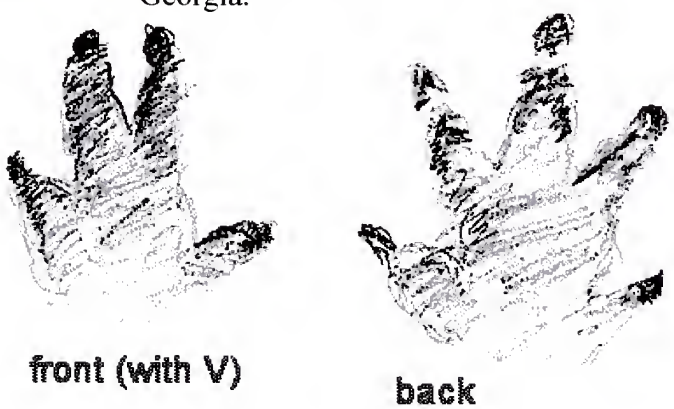


Figure 13. The trailer carrying the buckets of sand and mineral oil connected to the All-Terrain Vehicle.

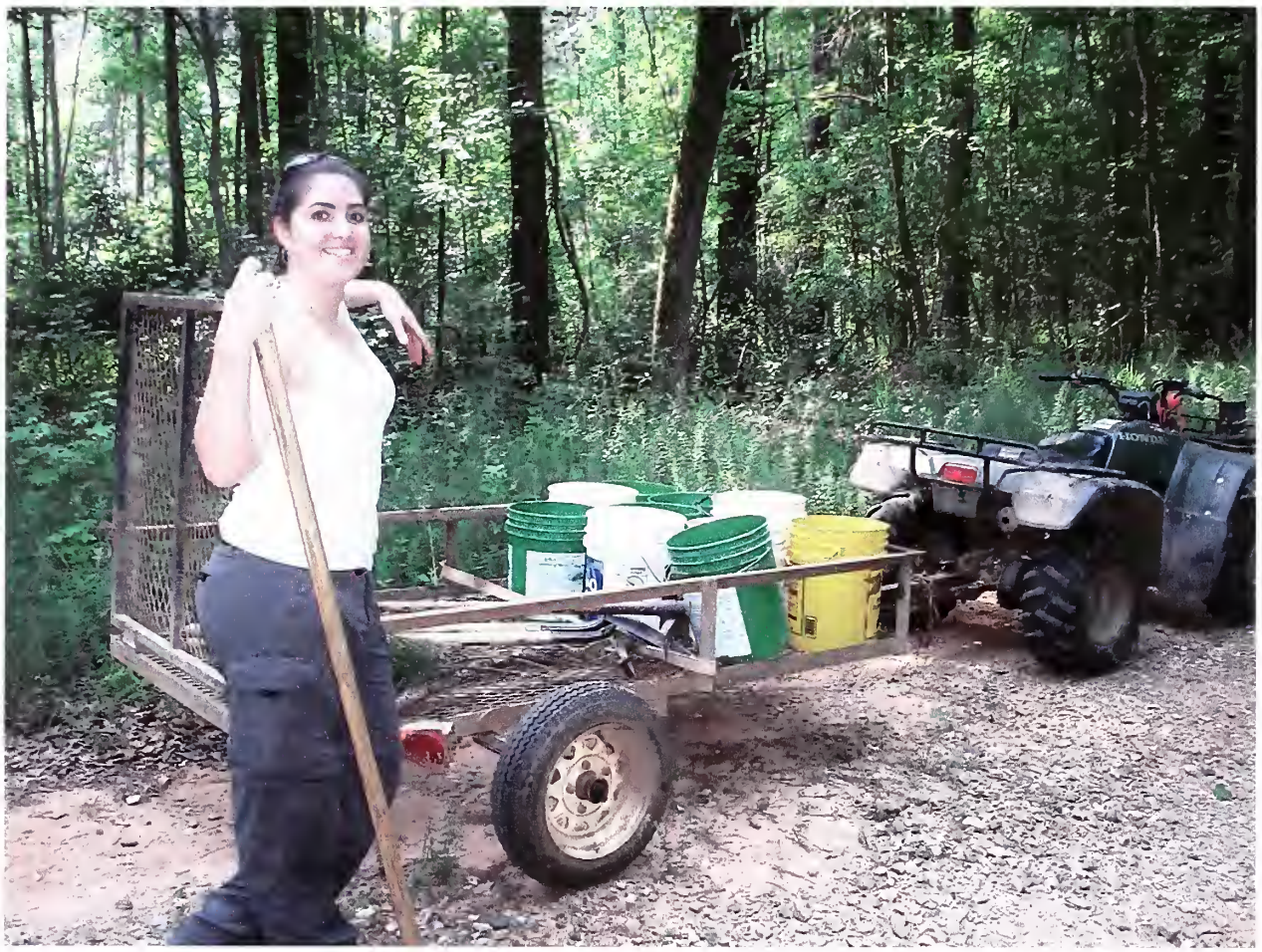


Figure 14. Sand and mineral oil mixture being poured into place.

Figure 15. Sand and mineral oil mixture being leveled.

Figure 16. Sweeping a scent-station to remove any extra sand bumps and debris.

Figure 17. Map of the Callaway Preserve, the locations of the scent-stations, and the routes taken.

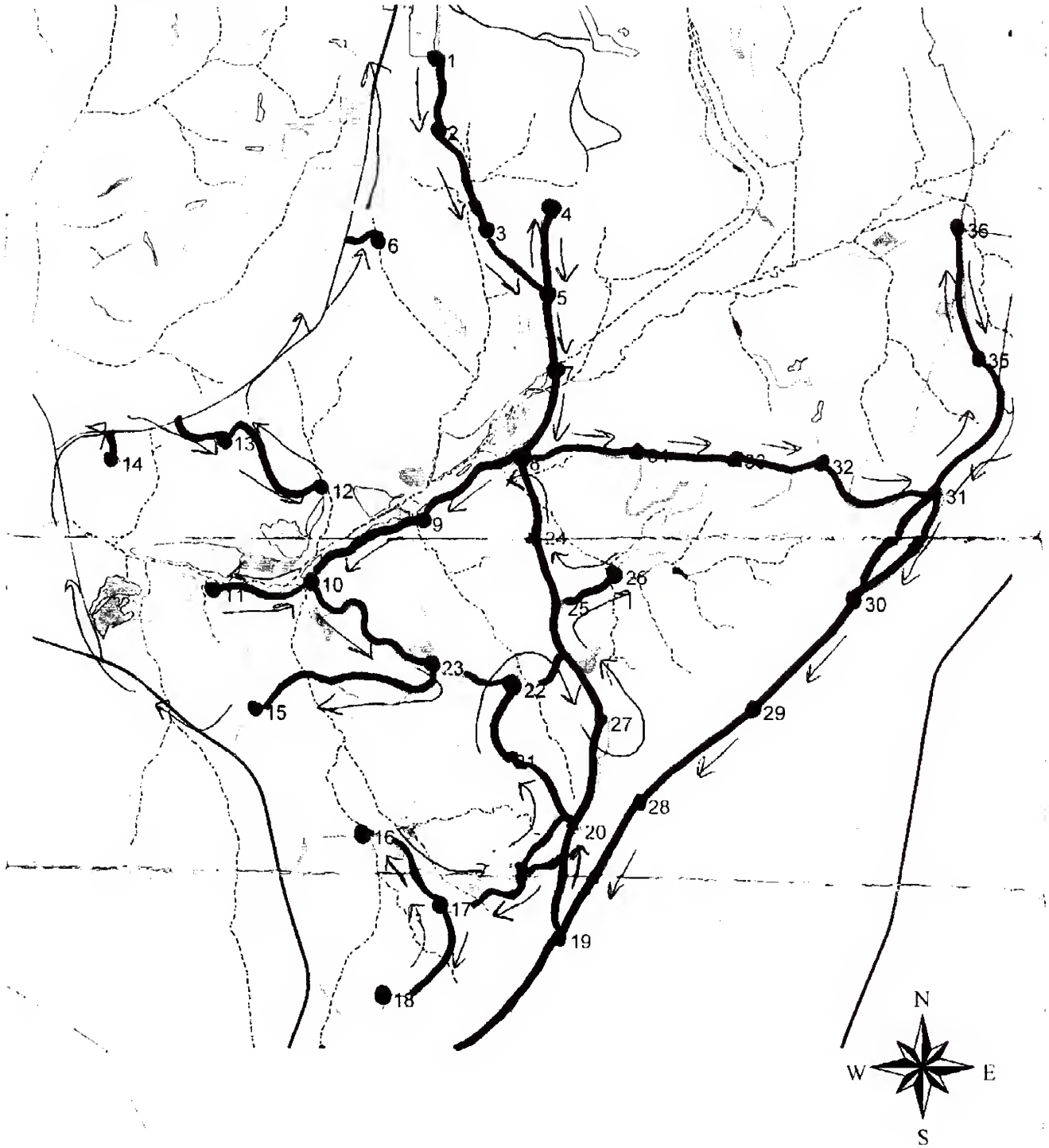


Figure 18. Comparison of the total number of visits at selected scent-stations by mammals on the Callaway Preserve, Harris County, Georgia.

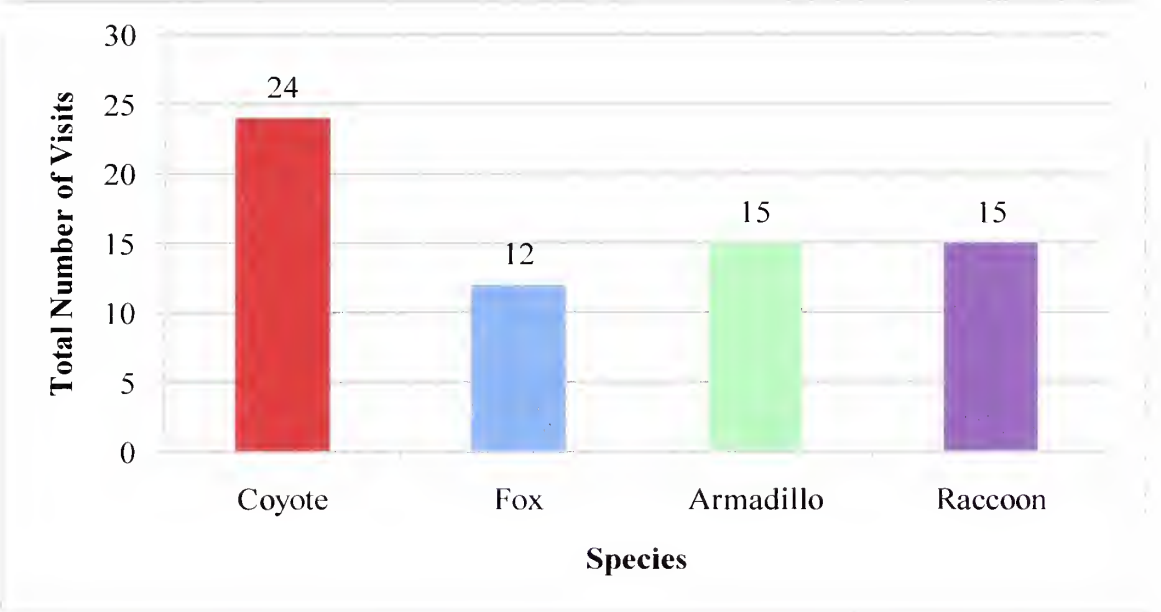


Figure 19. Comparison of the percentages of total visits at selected scent-stations by mammals on the Callaway Preserve, Harris County, Georgia.

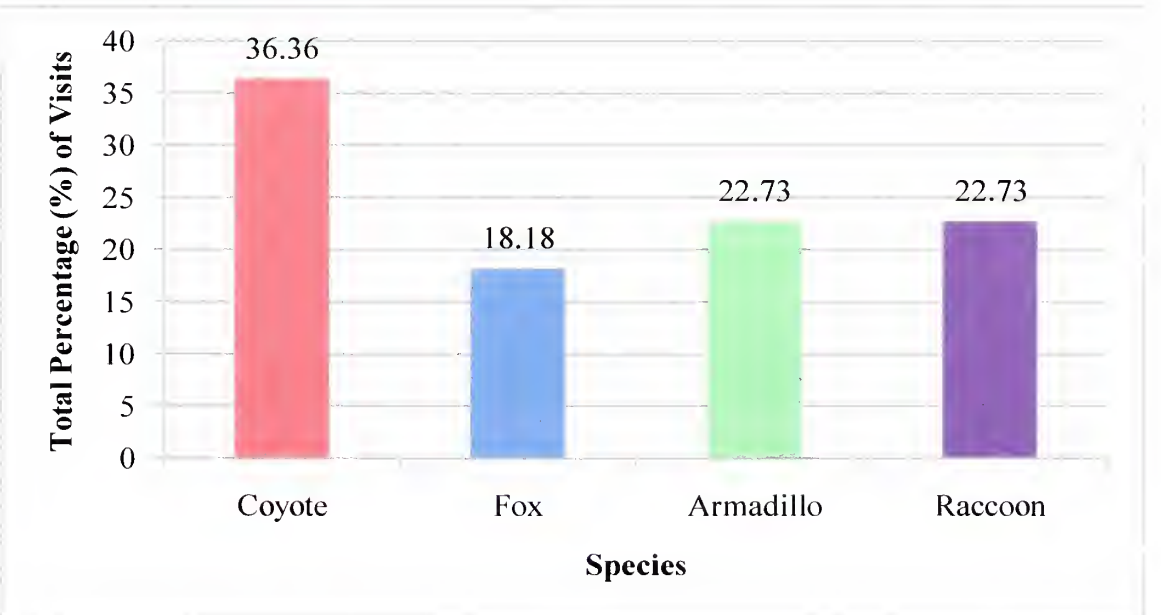


Figure 20. Percent occurrence of coyotes at three habitats on the Callaway Preserve, Harris County, Georgia.

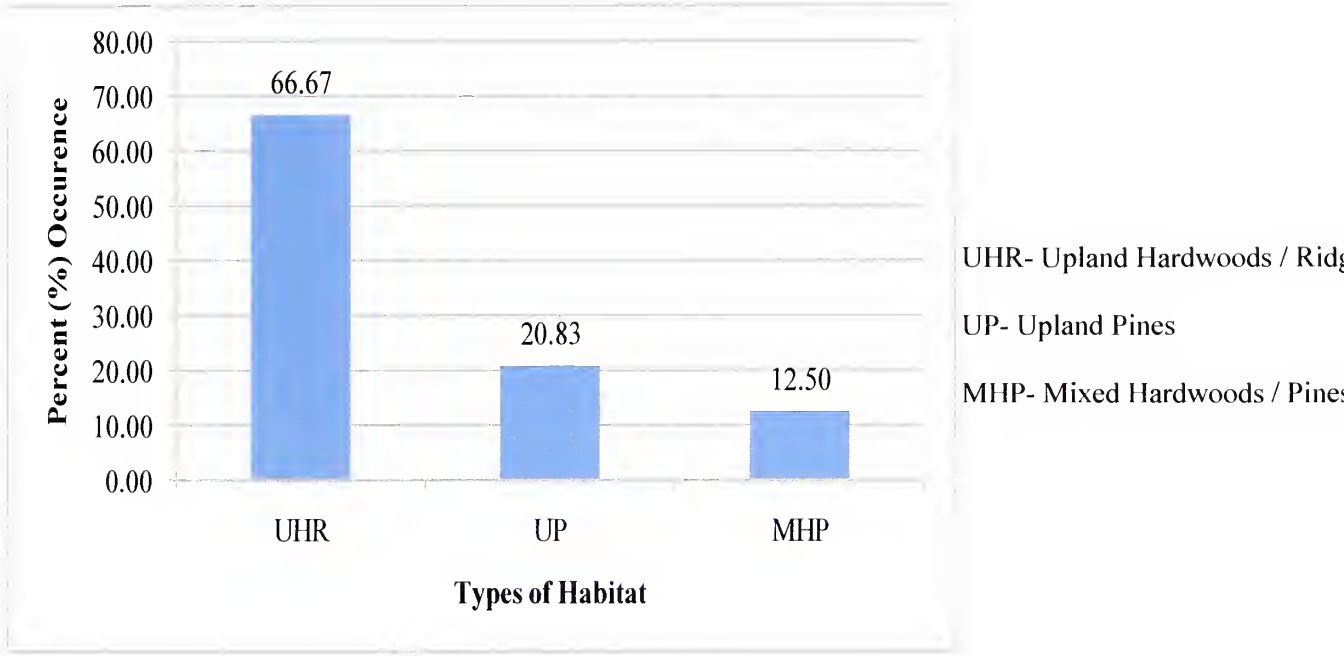


Figure 21. Percent occurrence of foxes at six habitats on the Callaway Preserve, Harris County, Georgia.

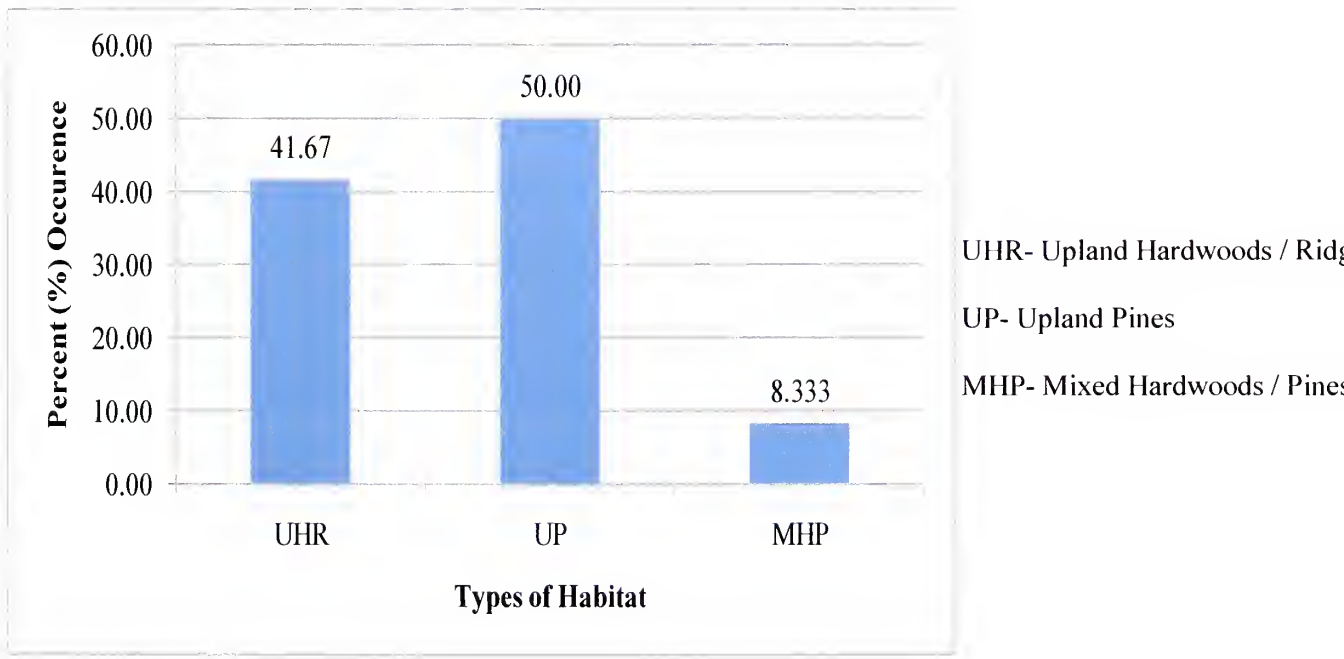


Figure 22. Percent occurrence of armadillos at six habitats on the Callaway Preserve, Harris County, Georgia.

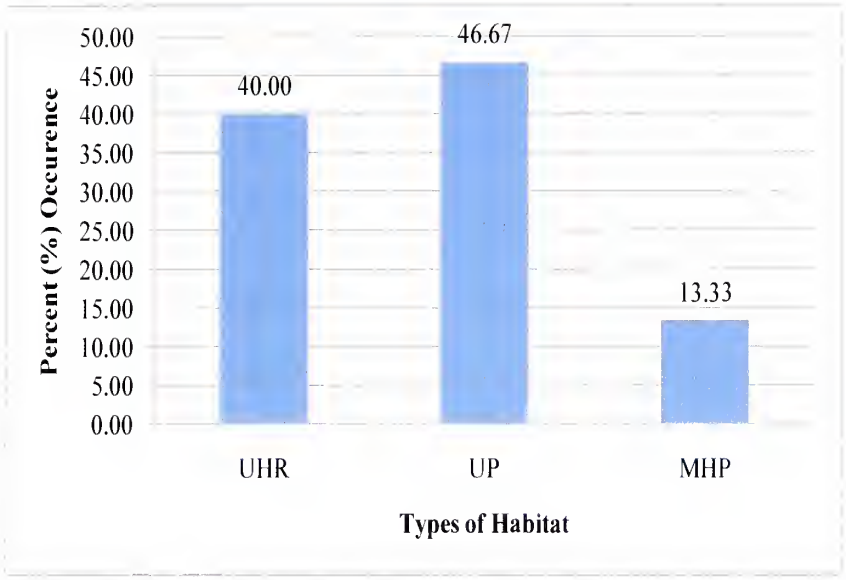
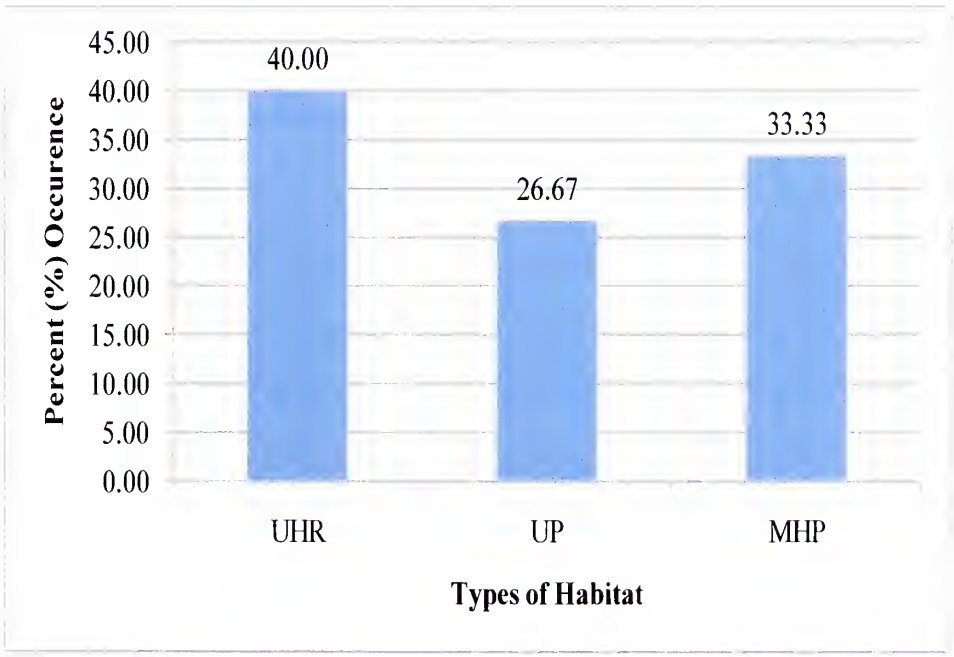


Figure 23. Percent occurrence of raccoons at six habitats on the Callaway Preserve, Harris County, Georgia.



Acknowledgements

I would like to thank Dr. William Birkhead for serving as my research mentor and Dr. Julie Ballenger for serving as my second reader. A huge thanks goes to Mr. Cory Croft, Wildlife Biologist at the Callaway Preserve, for the time he has taken to teach me all that he knows about tracking and scent-stations, and for the time he has spent helping me with the hard work of establishing the scent-stations. This project would not have been possible without him.

Thank you to Dr. Jeffrey Stratford for providing advice and editing my work. Thank you to Michelle Zambesi and Carmela Giacobello for their tremendous amount of help and assistance in collecting and recording data. I would like to thank my parents, family, and friends for all of their love and support through my research process.

I would like to thank Columbus State University for helping fund my research. Thank you to Dr. Barbara Hunt and Dr. Danna Gibson for being wonderful directors of the Columbus State University Honors Program and helping me through the process. Lastly, I would like to thank the Columbus State University Honors Program, and the donors of this program, for the countless opportunities provided to me over the past few years and during my research.

Appendix 1. Tracks of different species recorded at specific stations and dates on the Callaway Preserve, Harris County, Georgia.

Date	Station #	Species	Date	Station #	Species	Date	Station #	Species	Date	Station #	Species
6/9/2006	2	raccoon	6/11/2006	36	coyote	7/14/2006	8	fox	7/16/2006	12	armadillo
6/9/2006	8	raccoon	6/11/2006	29	raccoon	7/14/2006	33	fox	7/17/2006	32	fox
6/9/2006	31	fox	6/11/2006	25	coyote	7/14/2006	32	armadillo	7/17/2006	35	fox
6/9/2006	31	coyote	6/11/2006	11	coyote	7/14/2006	32	fox	7/17/2006	36	armadillo
6/9/2006	36	coyote	6/11/2006	21	raccoon	7/14/2006	32	coyote	7/17/2006	28	armadillo
6/9/2006	33	raccoon	6/11/2006	12	coyote	7/14/2006	31	fox	7/17/2006	28	raccoon
6/9/2006	28	armadillo	6/12/2006	5	coyote	7/14/2006	20	raccoon	7/17/2006	27	coyote
6/9/2006	19	coyote	6/12/2006	31	fox	7/14/2006	9	raccoon	7/17/2006	21	raccoon
6/9/2006	27	coyote	6/12/2006	31	coyote	7/14/2006	6	armadillo	7/17/2006	18	armadillo
6/9/2006	10	raccoon	6/12/2006	29	raccoon	7/15/2006	32	fox	7/17/2006	13	coyote
6/9/2006	21	coyote	6/12/2006	28	armadillo	7/15/2006	36	raccoon	7/18/2006	2	armadillo
6/9/2006	17	coyote	6/12/2006	19	coyote	7/15/2006	36	coyote	7/18/2006	7	coyote
6/9/2006	18	coyote	6/12/2006	20	raccoon	7/15/2006	29	coyote	7/18/2006	32	fox
6/9/2006	14	coyote	6/12/2006	26	raccoon	7/15/2006	28	armadillo	7/18/2006	32	armadillo
6/9/2006	12	fox	6/12/2006	24	armadillo	7/15/2006	25	armadillo	7/18/2006	36	armadillo
6/9/2006	6	armadillo	6/12/2006	17	coyote	7/15/2006	9	raccoon	7/18/2006	29	coyote
6/10/2006	1	opossum	6/13/2006	8	raccoon	7/15/2006	22	raccoon	7/18/2006	28	coyote
6/10/2006	31	coyote	6/13/2006	28	armadillo	7/15/2006	6	armadillo	7/18/2006	19	coyote
6/10/2006	31	fox	6/13/2006	15	armadillo	7/15/2006	5	armadillo	7/18/2006	20	coyote
6/10/2006	29	raccoon	6/13/2006	13	raccoon	7/16/2006	8	coyote	7/18/2006	9	coyote
6/10/2006	23	raccoon	6/13/2006	6	armadillo	7/16/2006	33	armadillo	7/18/2006	15	armadillo
6/10/2006	14	coyote	6/13/2006	6	raccoon	7/16/2006	30	fox	7/18/2006	23	coyote
6/11/2006	2	raccoon	7/14/2006	3	armadillo	7/16/2006	29	coyote	7/18/2006	17	armadillo
6/11/2006	32	fox	7/14/2006	3	raccoon	7/16/2006	25	raccoon	7/18/2006	18	coyote
6/11/2006	31	coyote	7/14/2006	7	raccoon	7/16/2006	10	raccoon			